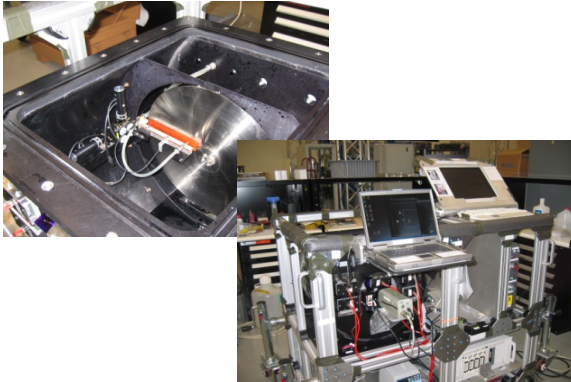


## Sub-System Coupling for Grey Water Purification/IV Fluid generation using Energy Sourced from Control Moment Gyroscopes (CMG)

Comprehensive redundant grey water purification and IV fluids generation (when required) systems that dramatically lower mass and reduced power requirements than current flight systems using Passive Energy Acquisition. The resulting multi-disciplinary system has the potential of better packaging options due to reduced overall volume. It is anticipated that this system would be employed on all four CMG's adding redundancy to potable water reclamation from grey water.



### MAIN ACHIEVEMENT:

*Several of the components of the proposed system are fairly mature technologically, it is the integration & coupling of these sub-systems into a viable comprehensive system that makes this development unique.*

### HOW IT WORKS:

This process relies on a Wiped-Film Rotating-Disk (WFRD) to provide the evaporation and condensation surfaces that make distillation possible in zero-g. Researchers will advance the Vapor Phase Catalytic Ammonia Removal (VPCAR) technology study viability of coupling it with the existing Control Moment Gyroscopes (CMG) flywheel subsystems technologies to enable reduction of mass, power usage and system complexity.

### ASSUMPTIONS AND LIMITATIONS:

- Testing is required to study viability of incorporating these technologies utilizing similar devices (rotating disks).
- Potential power budget issues need review.

### Technical Approach

The proposed system involves the integration of an existing flight system, the vehicle orientation gyros Control Moment Gyroscopes (CMG's), similar to those found on the ISS, with the Vapor Phase Catalytic Ammonia Removal (VPCAR) subsystem (employing a rotating disc) used in grey water reclamation. The VPCAR subsystem hardware has successfully flown previously on several Reduced Gravity Flights through Glenn Research Center (GRC) and its current test readiness level (TRL) is seven (7), with modification and after additional reduced gravity testing, this hardware subsystem would be brought to TRL nine (9). The IV Generation Technology (IV Gen) is currently being prepared for technology demonstration on the ISS by the Kennedy Space Center, and would be integrated as needed during mission deployment. The KSC team members will also gain fluency in the VPCAR process which differs from their biological water recycling process research. Future work will be able to benefit from the blending of the two strategies for maximum performance. Initial testing would be performed aboard Reduced Gravity Flights (RGF) with follow on development and integration and test aboard ISS, and ultimately it would be applied to new manned vehicle designs.

### Technology Goals:

Following review, analysis and documentation of results from the RGF testing of the modified VPCAR system to proof modified water heating system and varying disc speeds, in conjunction with and after testing of the IV fluid generation system aboard ISS, the subsystems will then be integrated and prepared for testing as a comprehensive system test, first aboard reduced gravity flights and then aboard the ISS. Ultimately the new system would be applied to new manned vehicle designs.

*Discussions with GRC personnel on availability of the VPCAR subsystem as well as current KSC development of the IV fluids Generation system make this proposal very timely.*

*Subcomponent coupling and testing to proof the concept would allow for a future 'all up' system fabrication and test.*

Development of this system would call to several components of the Technology Capabilities List including; 1.5.3 Fluid conditioning and control, 3.1.4 Flt Support Systems, 4.1.3 in-situ remediation of environmental contamination

The novel integration of a life support system with an attitude control system for unprecedented mission performance.